

# CE 401 – Concrete Technology

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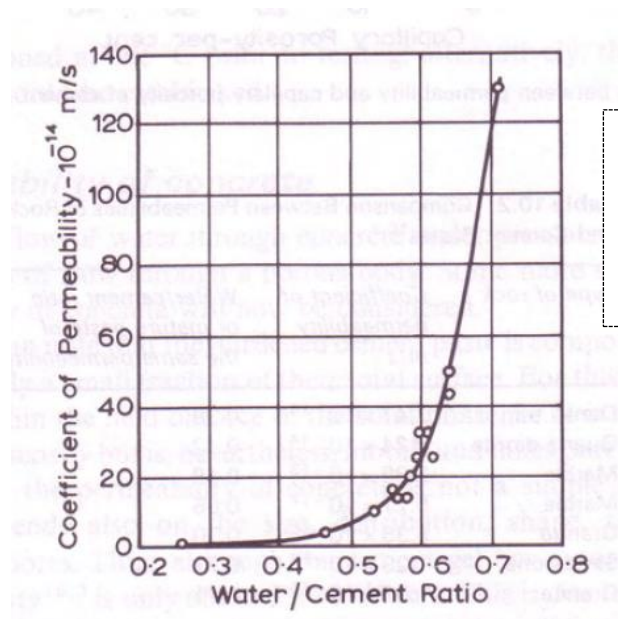
Homework Assignment # 2 [Key Solution]

[Permeability & Half-Cell Potential]

## 1. Discuss briefly three methods to reduce concrete water permeability.

- i. Reduction of w/c ratio which will result in less water in the fresh mix and hence less pores in the hardened concrete.
- ii. The use of cement replacements like microsilica which will increase the density of concrete which will make it more difficult for the water to go through.
- iii. The use of waterproofing admixtures which work as internal barrier against water ingress.

## 2. Approximately, what is critical water-cement ratio after which the coefficient of permeability (as an indication of permeability) increases rapidly? Show a graphical relationship.



As can be seen from this figure, a w/c ratio of about **0.60** is the critical value after which the coefficient of permeability increases rapidly.

**3. Does the presence of aggregate in concrete affects the permeability? Explain.**

The answer to this question would be **YES**, since the permeability of aggregate affects the permeability of concrete. If aggregate has low permeability, its presence reduces the effective area over which flow can take place. In addition to that the path of flow of water becomes longer when the aggregate is less permeable.

**4. Why the half-cell potential test is called like that?**

A full-cell requires complete circuit, i.e. the measuring equipment shall be connected to both ends of steel bars, and hence it is connected from one end only it is called half-cell.

**5. What are the outcomes of a half-cell potential test and how they are utilized?**

**Outcomes:** The electrical half-cell potentials

**Application:**

- i. Assessment of the durability of reinforced concrete members where reinforcement corrosion is suspected.
- ii. Finding high reinforcement corrosion risk areas.
- iii. It can also be used for investigating concrete contaminated with salts

**6. Discuss the limitations of the half-cell potential test.**

- i. The method cannot indicate the actual corrosion rate.
- ii. It may require to drill a small hole to enable electrical contact with the reinforcement in the member under examination, and surface preparation may also be required.
- iii. Effect of protective or decorative coatings applied to the concrete need to be taken care of.